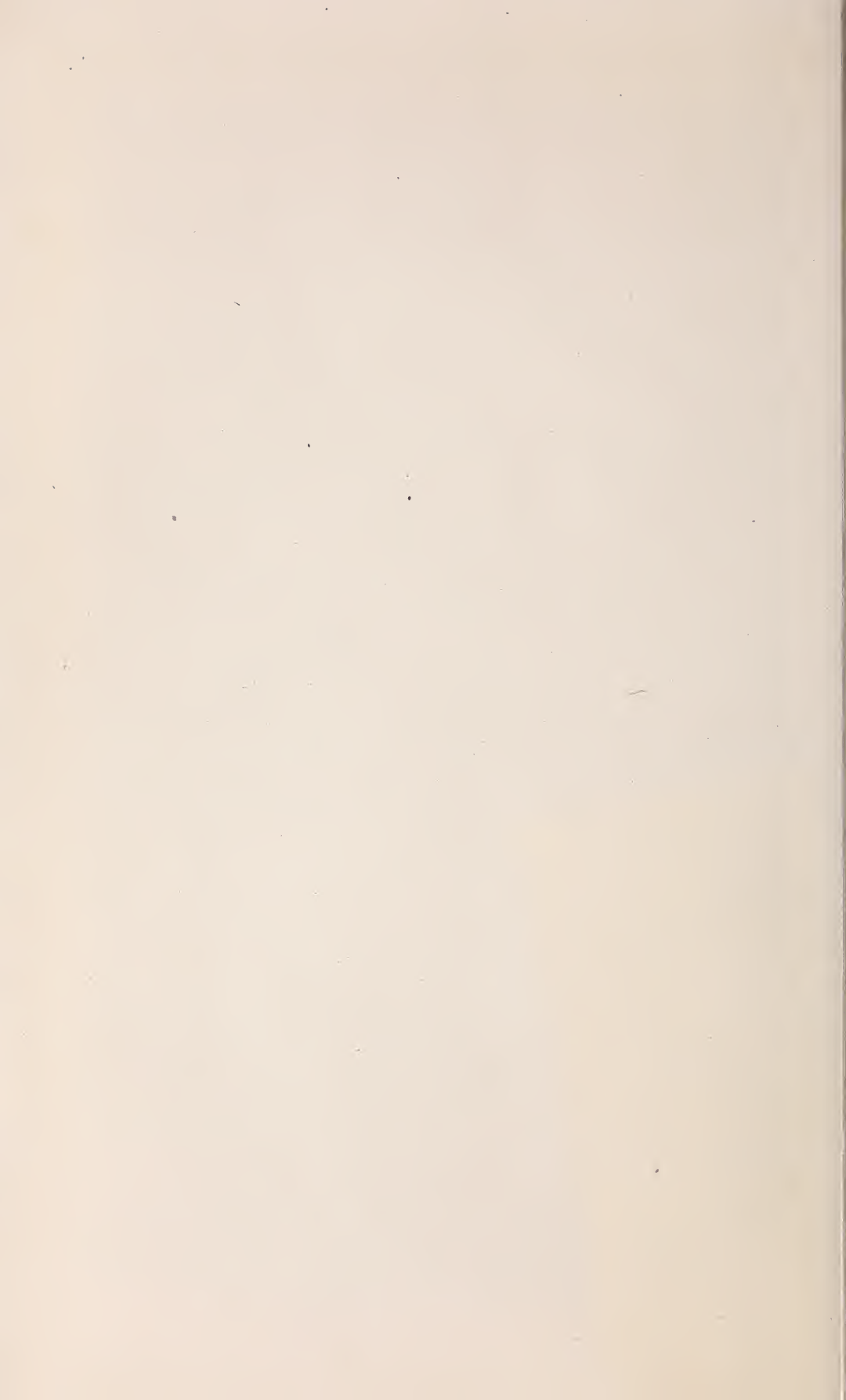


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REPORT OF THE CHIEF OF THE BUREAU OF HUMAN  
NUTRITION AND HOME ECONOMICS, AGRICULTURAL  
RESEARCH ADMINISTRATION, 1948

UNITED STATES DEPARTMENT OF AGRICULTURE,  
*Washington, D. C., September 28, 1948.*

Dr. P. V. CARDON,  
*Agricultural Research Administrator.*

DEAR DR. CARDON: I submit herewith the report of the Bureau of Human Nutrition and Home Economics for the fiscal year ended June 30, 1948.

Sincerely,

HAZEL K. STIEBELING,  
*Chief.*

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The Bureau of Human Nutrition and Home Economics completed on June 30, 1948, its first quarter century of research on behalf of the Nation's homemakers.

In June 1923 the Secretary of Agriculture announced that "pursuant to provisions contained in the Agricultural Appropriations Act for the fiscal year 1924" the Office of Home Economics would become the Bureau of Home Economics on July 1, 1923. Eight leaders in home economics whom he had invited to help plan the organization of the new agency recommended the following divisions of work: Food and nutrition, clothing and textiles, economics (including household management), housing and equipment, home relations, art in the home. The research program of the Bureau today is concerned primarily with the first four of these fields.

## FOOD AND NUTRITION

The Congress has appropriated funds for the Department of Agriculture to investigate food and nutritional problems since 1894. The first authorization was for studies of "the nutritive value of the various articles and commodities used for human food, with special suggestions of full, wholesome, and edible rations, less wasteful and more economical than those in common use." During the two decades that followed, Dr. W. O. Atwater, under whose direction such studies were first placed, conducted research on food composition, food consumption, and human nutritional requirements. This work was transferred in 1914 to the Office of Home Economics, and in turn in 1923 to the Bureau of Home Economics, where it has been greatly intensified.

### FOOD COMPOSITION

**EFFECT OF COOKING ON NUTRITIVE VALUE OF FOODS.**—Chemical composition of food as eaten may differ from that of food in the form in which it arrives in the kitchen. Yet this is the form to which most tables of food composition now relate. The task of accumulating scientific data on the composition of food as eaten is tedious and time consuming, because it is complicated by the many different cooking procedures in common use and by the fact that various nutrients respond differently to the various temperatures, times, and procedures of canning, freezing, and cooking. As data on the subject appear in the world's scientific literature they are being collated by the Bureau, and from time to time, summaries of current knowledge on composition and nutritive value of food as eaten are published in tabular form.

The paucity of information in this general field led the Bureau in 1941 to undertake laboratory investigations of the vitamin and mineral content of a large number of foods as affected by two or more methods of home preparation. This research was supported in part by an allotment made by the Secretary of Agriculture from Special Research Funds (Bankhead-Jones Act of June 29, 1935). The results, published this year in the 76-page Technical Bulletin No. 628, *Vitamin and Mineral Content of Certain Foods as Affected by Home Preparation*, show the changes in selected nutrients that occur during the cooking of many vegetables, meats, poultry, breads, and cereals. Household methods of preparation and cooking were used, such as boiling, baking, simmering, braising, pot roasting, and frying. Reproducible methods for sampling, cooking, and analysis were developed and standardized to make possible valid comparison of the nutritive value of raw and cooked food.

In choosing the nutrients to be studied, several factors were considered: Importance in meal planning; availability of a reasonably well-accepted method of assay; distribution of the nutrient in raw food, and its vulnerability to food processing. Whenever feasible, ascorbic acid and thiamine were included because they are sensitive to food-preparation treatments. Minerals and three relatively heat-stable vitamins—carotene, nicotinic acid, and riboflavin—were included, even when little or no change was expected. Their complete retention served as evidence that sampling procedures were satisfactory and that observed retention of the more readily destroyed vitamins was correct.



In general, the results demonstrate that with all the preparation methods used, cooked foods retain less of their ascorbic acid and thiamine than of nicotinic acid, riboflavin, carotene, and minerals.

Some specific results regarding ascorbic acid (vitamin C) are cited from studies of potatoes, to illustrate the type of information obtained:

Boiled whole in their skins, potatoes retained practically all of their original ascorbic acid.

When potatoes were pared before boiling, 70 to 80 percent of the ascorbic acid was retained in the drained cooked potato. Only about half of the ascorbic acid unaccounted for in the drained potato was found in the cooking liquid. Potatoes pared and quartered before boiling retained almost as much ascorbic acid as potatoes pared and boiled whole. The factor of greater surface area exposed appears to be offset by the shorter cooking time and smaller quantity of water.

Volume of cooking water affects retention of nutrients. The boiled quartered potatoes just mentioned were cooked in only enough water to cover. When similarly prepared potatoes were cooked in about three-fourths as much water, about 10 percent more ascorbic acid was retained.

Held overnight in the refrigerator, boiled potatoes lost considerable ascorbic acid. Potatoes boiled and held in their skins retained more ascorbic acid than those pared, boiled, and then held.

The pressure saucepan was used only with pared quartered potatoes. These retained about 80 percent of their ascorbic acid.

Mashed potatoes prepared from potatoes freshly boiled whole in their skins retained most of their nutritive value. But they retained only a little more than half of the original ascorbic acid when prepared from potatoes that had been pared, quartered, and cooked.

Destruction of ascorbic acid in hash browning was greater than in mashing, because of the second heating involved. The greater the amount of browning, the greater the ascorbic acid loss.

Potatoes baked whole in their skins retained 75 percent of their ascorbic acid.

Two methods of frying raw potatoes were studied: Country frying and French frying. In each case, ascorbic acid retention was about 60 percent.

**AMERICAN COOKING PRACTICES.**—Information on the prevalence of different cooking practices, as well as the effect of common cooking methods on nutritive values, is needed to improve estimates of the nutritive value of family diets as consumed, and to determine the focus of educational programs for conserving nutritive values. Some data on cooking practices were obtained from 645 farm families in California, Nebraska, and Rhode Island, through a cooperative study conducted by the Bureau and the experiment stations of the 3 States.

Potatoes were peeled and cut up before boiling by three-fourths or more of the families in California and Nebraska, and one-fourth of those in Rhode Island. Potatoes were cooked whole in their jackets by only 15, 6, and 21 percent of the families in the three States.

Only a few kinds of vegetables appeared frequently enough in the six meals reported by these families to permit analysis of length of cooking time, although this is an important factor in conserving the nutritive value of food.

Carrots were cooked less than 20 minutes by 48 percent of the families reporting them in California, 27 percent of those in Nebraska,

and 24 percent in Rhode Island; they were cooked 30 minutes to 1 hour by 20, 13, and 22 percent, respectively. Fresh green peas were cooked less than 20 minutes by most families reporting them in Rhode Island and California but somewhat longer by half the families in Nebraska. "Ten-minute" (or less) cabbage was reported only by a few California families. Three-fourths of the families in Nebraska and Rhode Island cooked cabbage 20 minutes to 1 hour.

#### HOME FOOD PREPARATION

Research is in progress to improve practical and efficient application of principles underlying home food preparation and preservation. Results are translated into popular guides for selecting and preparing food in the home, and for the effective use of food, consistent with price and supply conditions.

**MEAT CONSERVATION.**—To help homemakers economize in their use of the currently scarce and costly protein-rich foods, about 150 main-dish recipes featuring meat alternates and limited use of meats were compiled from the Bureau's records of past and current laboratory work. These were published in cooperation with the Office for Food and Feed Conservation. Their usefulness is indicated by the demand, which called for printing 5½ million copies.

**TURKEY QUARTERS.**—The production of large turkeys, built up during the war years to supply the armed services with meaty roasting birds, brought a postwar marketing problem of considerable proportions. To enlarge the retail market for these large turkeys it seemed practical to encourage the sale of parts of turkeys. At the request of the Production and Marketing Administration, the Bureau undertook the development of satisfactory methods of cooking these parts.

Frozen quarters sawed from large broad-breasted bronze toms were roasted by several methods selected in preliminary tests. Observations of the relative practicability of the various methods, and palatability tests of the cooked birds, showed that quarters can provide turkey in very acceptable form for a small household. Turkey quarters can be satisfactorily roasted, stuffed or unstuffed, by cooking them with skin greased or covered with a greased cloth, on a flat rack in an open pan with no added water in an oven at 325° F. Experiments are under way supported by Research and Marketing Administration funds to develop methods for cooking turkey steaks and disjointed parts.

**POTATO COOKERY.**—A joint effort of home economists and plant scientists in the Department has a twofold objective: To determine cooking methods most suitable for potatoes of different varieties, from various places of origin, and given various storage treatments; and to develop rapid chemical or physical tests that will predict suitability of these potatoes for specific culinary purposes. During the past year, in work supported by funds of the Research and Marketing Administration, nine varieties of potatoes, each grown in two or three locations of the United States and held at two storage temperatures for three different periods, were cooked by each of six different methods. Some of the stored potatoes were also reconditioned for different lengths of time to determine suitability for French frying. This work will be continued during 1948-49, using six varieties from three locations with the various treatments to judge their suitability for baking, boiling, mashing, and for salads, and other culinary uses.



## HOME CANNING

Studies on the home canning of low-acid foods were continued to supplement the list of 12 vegetables for which the Bureau established processing recommendations in 1946. Both in the Bureau's laboratories and through cooperative studies carried on at the Texas and Massachusetts experiment stations, heat-penetration and inoculated-pack data, basic to the development of safe canning processes, were accumulated for several additional low-acid products. Processes for the home canning of vegetable-beef stew and blackeyed peas were developed, and data on other products (lye hominy, baked beans, pork and beans, new Irish potatoes, and mushrooms), are nearly complete.

**BACTERIOLOGICAL STUDIES ON CANNED FOODS.**—Studies of the death rate of spore suspensions of a putrefactive anaerobe No. 3679 (more resistant to heat than spores of *Clostridium botulinum*) were carried out in juice from canned asparagus and juice from beets and in neutral phosphate buffer with adequate replication to provide satisfactory estimates of error variance. The resulting data made it necessary to abandon the theory that thermal-death-rate curves for spore suspensions of P. A. 3679 are logarithmic. Death-rate curves exhibit a definite lag during the initial heating periods, followed by a period of increasing rate of death which eventually becomes approximately constant.

Thermal-death-time determinations using spore suspensions of P. A. 3679 in juice from green peppers and mushrooms indicate that heating at 250° F. for 5 minutes for peppers and about 6 minutes for mushrooms is required to kill the spores. This means that both products require canning processes comparable to those now recommended for other low-acid foods, to make them safe from spoilage.

**QUALITY OF HOME-CANNED FOOD.**—A number of studies were begun or completed comparing the effect of modifications in preparation and packing techniques on the quality of specific home-canned foods. Some findings are:

Asparagus processed in completely sealed jars after exhausting, retained more liquid and was more palatable than that processed in partially sealed jars without exhausting. While observed differences in palatability were significant, good products could be obtained by either method. Since it requires considerable time and effort to exhaust jars before processing, the method chosen by the homemaker will depend upon the relative value placed on palatability and time required for canning.

In canning of apple slices, York Imperial apples when cold-packed for processing were found to be superior in flavor and texture to those packed hot. In both methods, texture was slightly improved by rinsing the slices in vinegar-and-salt solution before canning. When apples were cold-packed for processing, some antidarkening agent such as ascorbic acid was found necessary to prevent discoloration.

In carrying forward work reported last year on the home canning of chicken, research was initiated this year to evaluate preparation methods and procedures for canning cockerels. Flavor of breast meat of freshly canned cockerels packed raw or precooked in water was found to be slightly better than that of parallel samples precooked by browning and heated in their own juice for serving. Flavor of thigh meat in all three packs was similar. Breast meat in the browned pack was slightly less tender than in the other two kinds of packs.

When the canned chicken was prepared for serving by rolling the pieces in flour and frying to a golden-brown color, judges found no differences among the three methods of preparing chicken for canning. The products resembled fresh fried chicken in flavor, texture, and appearance.

#### HOME FREEZING

New or improved directions were developed for home freezing of several representative fruits as the result of studies on sweetened and unsweetened packs and the use of certain antidarkening agents. Palatability comparisons on freshly frozen Elberta peaches showed that sirup packs were generally superior to dry-sugar packs. In the latter, flavor, color, and texture scores increased progressively with three levels of added ascorbic acid (33, 66, and 132 mg. per pint package). When the same levels of ascorbic acid were used in sugar-sirup packs, the lowest level was as effective as the highest in preventing discoloration; other palatability factors were not affected. The stored samples have not yet been examined.

Investigations of various chemical and heat treatments on the quality of frozen York Imperial apple slices indicate that color is better when apple slices are steam-blanching before freezing. Flavor and texture are better in those frozen without blanching. Adding ascorbic acid improves texture but the addition of calcium tends to make the slices tough. Storage tests are in progress.

Studies comparing home-canned and home-frozen snap beans—a full-podded, stringless variety developed by the Bureau of Plant Industry, Soils, and Agricultural Engineering—showed over-all palatability scores, including flavor and color, of the freshly frozen product to be considerably higher than scores for parallel canned samples.

Thiamine content of the raw beans, which averaged 0.07 mg. per 100 gm., was not significantly lowered during canning, freezing, or preparation of the processed foods for serving. Ascorbic acid content of the raw beans averaged 10 mg. per 100 gm., of which about 85 percent was retained in the frozen beans and only 55 percent in the beans when cooked. The canned beans retained 60 percent of their ascorbic acid but only 30 percent after heating for serving. Ascorbic acid retention after boiling the canned beans for 10 minutes was not significantly less than that of the beans heated to serving temperature.

#### SCHOOL LUNCH RECIPES

Cooperative with the Production and Marketing Administration, research is conducted in the interest of improving school feeding.

Utilizing commodities available in special abundance, recipes are developed in quantities to serve 100 children. The product is evaluated at each stage of development by a tasting panel of home economists. Food costs of each portion are calculated to assure economical recipes within usual school lunch budgets.

Before publication, each recipe is tested in actual school situations to verify clarity of directions, yield as prepared and served, and suitability for school facilities and equipment. In these tests the product is prepared by the school lunch cook following the written directions. The pupils' acceptance of the food is judged by the quantity of plate waste, by their selection in preference to other foods if a choice is



offered, and by the comments of teachers, pupils, and school lunch workers.

During the past year new recipes were released on potatoes, dried fruit, peanut butter, fish (in cooperation with the Fish and Wildlife Service), dried whole egg, and nonfat dry-milk solids. Recipes were developed utilizing dried egg and nonfat dry milk in mixes for puddings and baked goods. These may be prepared in a school lunch kitchen and stored for several weeks, thus distributing the work load. Products prepared from them proved highly acceptable to Bureau judges and to pupils in the schools where they were tested.

In many recipes nonfat dry milk was combined with other foods in main dishes, vegetable dishes, desserts, and sauces so as to provide a higher proportion of milk solids than would have been possible with fluid skim milk. A new recipe was developed for whipped-milk topping, easily made by whipping a concentrated mixture of the milk solids and water.

#### NUTRITIONAL REQUIREMENTS

**FOOD REQUIREMENTS OF CHILDREN.**—Early in the Department's research on nutrition there was built and operated the world-famous Atwater-Rosa respiration calorimeter, the first successful instrument devised for determining accurately the intake and output of matter and energy of human subjects. That work was an important part of a series of fundamental researches which led to more simplified procedures for estimating the food energy requirements of human beings.

Today, using a respiration chamber and other apparatus for measuring metabolic rate, the Bureau is cooperating with Columbia University in studies of the food energy requirements of children. With 38 boys and 39 girls 9 to 11 years of age as subjects, information has been obtained on the basal metabolism of normal children, and the added energy cost of carrying out 15 physical activities that are part of the everyday life of children, such as walking at different speeds; sitting quietly or engaged in eating, writing, singing, or sewing (girls); standing quietly or engaged in writing or drawing at a blackboard, washing and wiping dishes, dressing and undressing, playing the violin, or carpentry (boys). A report is in press. Also in progress or in immediate prospect are studies of more strenuous activities, as running, roller skating, climbing stairs, jumping rope, and swimming.

Investigations in cooperation with the Oregon Agricultural Experiment Station are adding to the knowledge of the ascorbic acid requirements of adolescents. Among 81 children 11 to 18 years old living in an institution, the plasma ascorbic acid values of 71 percent of the girls and 42 percent of the boys were found below 0.60 mg. per 100 gm., a commonly used criterion of adequacy. In controlled feeding experiments, it has been found that the allowances for vitamin C recommended by the National Research Council do not maintain "saturation" of body tissues, but do maintain plasma values well above 0.60 mg. per 100 gm.

**VITAMIN A AND CAROTENE REQUIREMENTS.**—Previous work of the Bureau in measuring the human requirements for vitamin A when the source was cod-liver oil or the provitamin carotene from different sources—crystalline carotene in cottonseed oil, spinach, peas, and carrots—indicated the body's unequal utilization of this nutrient from the several foods. Not only did 0.6 gamma of beta carotene appear to be

less well used by the human being than an International Unit of vitamin A from cod-liver oil, but about three times as much carotene seemed to be needed when derived from carrots as when consumed in spinach or peas.

Studies completed this year show that only one-fourth to one-third of the carotene of two yellow root vegetables, carrots and sweetpotatoes, appears to be used by the rat for growth, as compared with two-thirds of that from a green leafy vegetable, kale. When the vegetables were fed to laboratory animals in mashed or pureed forms, no improvement was observed in the utilization of the carotene. When extracted and fed in an oil solution, the carotene of all three vegetables was utilized as well as pure beta carotene.

These studies indicate the need for reporting separately figures for carotene, measured chemically, and for vitamin A, measured biologically. They also indicate the need for much more experimental data on human utilization of carotenes from different food sources.

**SUPPLEMENTARY RELATIONSHIPS AMONG FOODS.**—Fed basal diets of a few ordinary foods including wheat bread, small amounts of fat, and vegetables but no milk, eggs, or meat, experimental animals were found to have exceptionally low stores of vitamin A in the liver, even when cooked carrots or kale were included in amounts that were expected to supply more than five times the minimum carotene requirement. When kale in this diet was stepped up to a level allowing 70 times the minimal carotene requirement, the kale provided for normal vitamin A reserves in the liver. Liver storage of vitamin A was somewhat improved by including skim milk in the diet.

Previous findings that the growth, reproduction, and lactation of rats on the basal diet described above could be improved by the addition of skim milk, led to similar studies using eggs and beef as a supplement in amounts that would supply as much protein as the milk. Additions of dehydrated egg (reconstituted and scrambled) and roast beef promoted good weight growth in animals up to maturity. However, bone deformities developed and reproduction was poor unless calcium or a calcium-rich food was given, and lactation was unsatisfactory, even with added calcium and vitamin D. Apparently milk contains some factor or factors essential for normal lactation which was still lacking in the basal diet supplemented only by egg or beef.

## FAMILY ECONOMICS

### FOOD CONSUMPTION IN CITIES

Under the Research and Marketing Act of 1946, two studies of food consumption among urban families were initiated this year to show where potential market outlets for food exist in this country and to give a basis for judging nutritional adequacy of postwar diets.

During the spring of 1948, a survey was made of the food consumed by a cross section of housekeeping families of two or more persons in urban communities in the United States. Almost 1,600 families living in 68 cities gave this information. The results will permit comparisons of food consumption and dietary adequacy of families in various income groups with data obtained 6 years earlier.

During the winter and again during the late spring months of 1948, facts were obtained on the quantities of food consumed by housekeep-



ing families in four large urban areas—San Francisco, Birmingham, Minneapolis-St. Paul, and Buffalo. This survey will be repeated in the fall to give seasonal changes.

#### HOW FAMILIES USE THEIR INCOMES

The Bureau inherited from the Office of Home Economics its active interest in farm family consumption and income and in helping these families and public leaders to understand the problems involved in improving rural levels of living. Studies made by the Bureau and other groups during the past decade or two have provided much information on the quantities of different goods and services consumed by farm families and the factors affecting consumption. This year the Bureau has summarized these findings in an illustrated publication, Miscellaneous Publication No. 653, *How Families Use Their Incomes*. Designed for use by teachers, students, social workers, and others who work with families, this publication describes trends in family spending patterns—both rural and urban—and shows how these differ among groups of families.

Although the number of dollars spent for living has changed a great deal since the middle 1930's, differences among families in patterns of spending have changed very little when families are classified by income, size, and place of residence. Many of these patterns are described in the publication. Some examples follow:

**SPENDING AND SAVING BY INCOME LEVEL.**—When families are sorted by income, certain points in their spending patterns stand out. At the lowest economic level most families do not cover their year's expenditures with the year's income. Many go into debt or draw on past savings. At high levels not all the income is needed to cover living expenses and an increasing share goes to savings or paying debts.

At all income levels a large share of the total goes for food and housing—including rent, heat, light, furnishings, and such expenses of home owners as taxes, repairs, and interest on the mortgage. Dollars spent for food increase with income, but the share decreases from about 40 percent at the lower levels to about 25 percent in the upper.

Amounts spent for clothing, medical care, and the group of expenditures that includes personal care, recreation, and education are larger at each successive income level, but each takes an almost constant share throughout the range of incomes. The share spent for the automobile and other transportation and for gifts and taxes, on the other hand, increases slightly with higher income.

**REGIONAL PATTERNS OF SPENDING AND SAVING.**—Spending by farm families differs between North and South. Southern families spend less than northern for each major group of items. Their incomes on the average are lower. Expenditures for housing and household operation are especially low in the South. The milder climate accounts for some, but not all, of this difference. Electricity expense, for example, comes to less in the South, where fewer farms have electric service.

Differences in family spending among regions also occur even when families have the same income. In a comparison of the spending of farm families in three regions which differ greatly in income level, families with the same dollar incomes spend more for living in the high-income region and devote less to savings and investment than



those in the lowest income region. The opportunity for spending and the social pressure to spend are evidently less in the low-income region, for higher incomes brought little increase in spending there. Influenced by the level of spending around them, families in the high- and moderate-income regions show steady increases in spending at each higher income level.

**TRENDS IN SPENDING FOR MEDICAL CARE.**—In the country as a whole, families greatly increased their spending for medical care during and after World War II. In 1946 per capita spending for medical care was twice what it was in 1936. Part of the increase is accounted for by price advances, but more important is the increase in amount of care obtained. Although farm families greatly stepped up their spending for medical care from 1936 to 1946 they were still spending less per capita in 1946 on medical care than city families.

Just as high-income families spend more for medical care than the average family, so also in areas where the general income level is relatively high, expenditures for medical care are greater than in areas where income is lower. In 1945, farm families in the North Central States spent, on the average, about 40 percent more for medical care than those in the South. Only for drugs and medical supplies did southern families spend more than northern. Together these purchases took a larger part of the southern family's medical-care dollar than any other item except physician's care. Northern families spent more for physicians' care and for hospital and dental care than for medicines and drugs.

**SOME FACTORS AFFECTING CLOTHING EXPENDITURES.**—Clothing expenditures are affected by many factors, such as family income, place of residence, age, and number of children in family.

Clothing expenditures of both husbands and wives increase appreciably with income. Farm wives in the highest income bracket spend nearly twice as much for clothing as do those in low-income groups. For farm husbands, the increase with income is somewhat less. At each income level, the wife spends more for clothing than the husband. This same spending pattern holds true for families in cities.

Where the individual lives—in a large city, a small city, a village, or on a farm—has an effect on the amount spent for clothing, and the greater the urbanization, the greater the outlay. For both husbands and wives, the spending for apparel rises markedly from farm to village, from village to small city.

The amount spent for clothing at successive ages first rises, then falls. As children grow older, expenditures for their clothing mount. The peak is reached when men and women are in their twenties or thirties. From then on, spending tends to decline with increasing age. For farm husbands at three age levels—under 40, 40 to 60, 60 or older—clothing expenditures drop successively. Although city husbands at all ages spend more for clothing than do those on farms, they, too, spend relatively less after 40 than in earlier years. Clothing expenditures of wives are similarly influenced by age. The decline of their spending appears even more marked than that of their husbands—probably because of their freer spending in earlier years.

A change in size and composition of the family group affects the clothing-expenditure pattern of various members. Many studies show that more is spent for clothing as the family grows larger. But other

changes such as those in income, age of parents, and age of children, affect the pattern. When these factors are held roughly constant, both husband and wife tend to spend less on their own clothing when a child is added to the family. In both farm and city families, the wife cuts down her clothing expenditure more than the husband. The city husband and wife each reduce their spending on clothing more than do the husband and wife in a farm family.

#### ADJUSTMENTS OF RURAL FAMILIES TO ECONOMIC CHANGE

During the year a study in Tennessee was completed, designed to determine the effects of change in income, family size, and residence on consumption by rural families. The final report includes detailed information on the income and expenditures in 1944 of 380 white farm families and 129 white rural nonfarm families in one county. It also gives facts on the changes in income, expenditures, and family size that occurred among these rural families from 1943 to 1944, a period of wartime prosperity and rising incomes.

The findings make clear that the income of a previous year, as well as current income, influences spending. This is important in understanding income-expenditure relationships. Families whose incomes were less than in the preceding year spent more for living and saved less than did families at the same income level who had not suffered income decreases. This suggests that when families have a reduction in income there is a lag in adjusting their level of consumption.

Among families in the same income bracket in 1944, those whose incomes had fallen from 1943 spent more for most groups of goods and services than those whose incomes had risen. Those whose incomes had fallen devoted a larger proportion of their consumption dollar to housing and household operation than the group with increased incomes. The two groups divided the remainder of their consumption dollar in very similar fashion.

#### CONSUMPTION OF HOME-PRODUCED FOOD

The importance of home food production to farm families makes of special interest a recent study of regional trends in the per capita use of food produced on the home farm.

The data indicate a slightly upward trend in all regions in the consumption of home-produced milk and eggs. Consumption of both was greatest in the North Central region, least in the South Atlantic. Consumption of home-made butter was greatest in the South, least in the North Atlantic and East North Central regions. There has been a slight downward trend in use of home-made butter in the South, West, and North Atlantic regions, but a large decrease in the North Central.

Per capita consumption of home-produced chicken has been fairly constant within each region since 1936, with the North Central region consuming the most. Pork has been consumed in the largest quantities in the South and North Central regions, and in lowest quantities in the West. Of home-produced beef and veal, the West consumed the most, the South the least, with other regions following close to but somewhat below the West.



The North Central and North Atlantic regions consumed the greatest per capita quantity of home-grown potatoes, although the amount has been gradually declining. Prior to 1939, the smallest average quantity was consumed in the South. Since then, in contrast to the other regions, there has been an upward trend. The largest per capita quantity of home-produced sirup was consumed by farm families in the southern States bordering on the Gulf of Mexico, except Texas. Consumption of home-produced sirups has been gradually declining since 1930.

#### MEAL PATTERNS ON THE FARM

Education to improve diets should be based not only on knowledge of the kinds and quantities of foods families use, but also on the way these foods are combined in meals. Interviews with farm families made cooperatively with three State experiment stations—Rhode Island, Nebraska, and California—provided data on patterns of six consecutive meals in more than 600 households.

Substantial breakfasts were usual in three-fourths of these homes. Cereal and eggs were found to be mainstays, each appearing in one-half to three-fourths of the breakfasts in the three States. Bacon or other meat or fish appeared in fewer than one-half, and griddlecakes, waffles, or French toast in fewer than one-fifth of the breakfasts. About one-half of the breakfasts in each State included fruit or juice.

Noon and evening meals were much alike and tended to include meat, potatoes, vegetables, and dessert. Nebraska families were more likely to have their heaviest meal at noon than families in more urbanized California and Rhode Island. More so-called light meals were served in Rhode Island.

#### ECONOMIC DATA FOR OUTLOOK CONFERENCES

As part of the Department's annual Outlook Conference, chart books are prepared each year which bring together information on various phases of family living, including population, income, prices, family expenditures, food, clothing, housing, and health. While many of these charts are based on original data collected by the Bureau, material is drawn from other sources also. Much of the latter material may require extensive analysis before use in the chart book. Contacts are maintained with the Bureau of the Census, the National Office of Vital Statistics, the Department of Commerce, the Bureau of Labor Statistics, and the Bureau of Agricultural Economics for pertinent data.

The interest shown in these economic analyses is indicated by the fact that about 9,000 copies of the 1947 chart book on Rural Family Living were distributed and more than 200 requests for large reproductions of individual charts were received. The number distributed of the 1948 chart book was somewhat greater.

In a special section of the 1948 chart book the Bureau presented data from account-keeping families in four States, comparing trends in spending of these farm families with those of all consumers in the United States (Department of Commerce data). These farm families increased their expenditures for living (other than housing, house-furnishings, and automobile) at about the same rate as all families



during the period from 1936 to 1945. But from 1945 to 1946 they increased their spending for living relatively more than all consumers. In spite of these increases, these farm families in 1946 were still spending less than the general average for consumer goods.

### HOUSING AND HOUSEHOLD EQUIPMENT

A Division of Housing and Household Equipment was not established until 1938. However, a survey of farm housing conditions in 46 States was made in the 1930's as a Civil Works Administration project, in cooperation with the Office of the Secretary, the Bureau of Agricultural Engineering, and the Extension Service, and some research on household refrigerators in connection with food studies was done in the late 1920's.

#### DEVELOPMENT OF NEW FARMHOUSE PLANS

Since farm families can seldom command individualized architectural service, the Department in cooperation with State agricultural colleges conducts a Regional Plan Exchange Service. The plans and working drawings for farmhouses incorporate the results of housing research in the Department and in the State agricultural experiment stations. The Department acts as a coordinator, assists the States in the preparation of plans, and in three of the four major regions publishes catalogs illustrating the plans that are available. The plans may be obtained by farm families through the State extension services.

Final working drawings for 12 house plans to be included in the northeastern regional plan book were completed by this Bureau in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering. In response to an announcement of the availability of working drawings for the first 8 of the plans, 1 plan was requested by 41 States, 2 by 39 States, 2 others by 38, another 2 by 36, and 1 by 29 States. Miscellaneous Publication No. 658, illustrating all the farmhouse plans prepared for the Northeast, is now in press.

#### STEP-SAVING KITCHEN PLANS

To help homemakers reduce time and work involved in kitchen activities, the Bureau is designing and preparing construction drawings for kitchens, with different arrangements of equipment—the U, L, broken U and L, and parallel-wall types of arrangement. They are designed to reduce walking, stooping, and stretching to a minimum, in accordance with accepted principles of work simplification.

This year the designing and construction of a U-arranged kitchen were completed and working drawings made available to farm families through the Regional Plan Exchange Service. The kitchen was on exhibit in the Department in the patio of the Administration Building and at the Agricultural Research Center, as well as at the thirty-ninth annual meeting of the American Home Economics Association in Minneapolis and at the 1948 Minnesota State Fair.

Miscellaneous Publication No. 646. A Step-Saving U Kitchen, was prepared to describe the features of the kitchen and to announce to the States the availability of the working drawings. During the first 2 months in which these plans were available, 37 States requested the brown-line prints from which to make blueprints for distribution.

In approximately the first 6 weeks the Bureau also received about 3,000 requests regarding the availability of the plans, and 29 States reported selling 1,068 sets of plans. Description of the kitchen and photographs were featured in 11 outstanding newspapers and magazines with Nation-wide circulation. A motion picture in color explaining details of the kitchen arrangement and equipment is nearing completion.

Working drawings for a series of Easy-to-Build Kitchen Cabinets were developed and made available to the Regional Plan Exchange Service. A multilithed booklet illustrating the working drawings was published to notify the States and interested agencies. With little national publicity, 28 States ordered the brown-line prints and by June 1948, 14 States had reported the distribution of about 1,000 sets of the plans.

#### PRESSURE SAUCEPANS

Operating characteristics of 18 pressure saucepans were studied and practical tests of their performance in use were made to evaluate physical characteristics, such as design of gages, handle, gasket, and closure. Results showed a tendency for the temperature in the lighter weight pans to reach a given point ( $212^{\circ}$  or  $250^{\circ}$  F.) in a shorter time than in the heavier pans, but there was no definite correlation of weight and time. A comparison of the performance of a  $2\frac{1}{2}$ - and 4-quart saucepan of the same material and design showed that size of pan did not appreciably affect the cooking times.

General conclusions regarding design: Spring-type gages are less accurate and give more variable results than weighted or indicating gages. Gaskets removable for cleaning are preferable to stationary gaskets. In general, long handles give better leverage for opening and closing than short "ear-type" handles. Handles should provide some protection from contact of hands with the metal of the pan. A definite marking for placement of cover on the pan for closing in the slip-clamp type of closure eliminates fumbling to get the cover in the right place. The weight of the pan without the cover should be such that it can be held in one hand for emptying.

#### COOKING UTENSILS

What a minimum set of kitchen utensils is and how much space is needed for its storage have long been problems to cabinet manufacturers, home economists, homemakers, and others interested in the purchase or sale of kitchen utensils and in kitchen planning. To help answer these questions, the Bureau, in cooperation with the California, Nebraska, and Rhode Island experiment stations, determined minimum and desirable number, kind, and size of utensils needed by farm homemakers to prepare meals with reasonable efficiency and convenience. Effects of family size and regional differences on the utensils used were also studied.

Based on information on meal patterns secured from 653 farm families in California, Nebraska, and Rhode Island, kits of utensils were assembled. These kits were placed in 30 farm homes in each of the 3 States for 3 weeks and studied for adequacy. The 90 cooperating homemakers represented a middle income group in each State and



included about the same number of families of four sizes—2, 4, 6, and 7 or more members.

Frequency of use of different items and the homemaker's experience as to their adequacy for her purpose provided information for developing two lists of utensils. In the minimum set are 50 utensils, each of which was used at least once a week by half or more of the 90 families. A more desirable set includes 22 additional pieces which were used at least once a week by 25 percent or more of the families.

Size of family was found to be of no significance in determining the number, kind, and size of utensils needed for the minimum set. However, when utensils were rated in the order of their frequency of use, differences by family size were noted. This variation in frequency of use would influence the arrangement and allocation of storage space.

No important regional differences were found in the frequency of use of the commonly used utensils.

## TEXTILES AND CLOTHING

### QUALITY OF FABRICS IN RETAIL MARKETS

In a study of the properties of staple woven clothing fabrics available to consumers during 1944 to 1946, 1,080 samples were examined by the Bureau and the four cooperating institutions in different geographic sections of the country: Minnesota, Pennsylvania, Tennessee, and Washington State.

Fabrics purchased in the period 1944 to 1946 were found to be considerably higher in price than those available prior to the war and inferior in colorfastness to washing, light, and perspiration. Many of the cotton and rayon fabrics bought in 1944-46 contained more than 10 percent nonfibrous materials (sizing). On the other hand, the fabrics differed relatively little in number of yarns per inch, weight per square yard, and breaking strength from similar fabrics obtainable before the war. The fabrics shrank less than prewar materials.

Fabrics of the same types were similar in characteristics regardless of geographic section or size of purchasing center. No marked changes in the properties of the fabrics were discernible during the progressive shopping periods over the 2 years covered by the study.

### FABRIC DETERIORATION

Causes of deterioration in cotton fabrics have been studied for some time as a basis for developing more effective ways to care for the family's textiles. Similar work pertaining to wool and other fibrous protein materials has been initiated.

The effect has been studied of several proteolytic enzymes upon various fibrous proteins, including wool, casein bristles, and fibers manufactured from peanuts, soybeans, corn, and milk. Under the conditions studied the enzymes digested all of the manufactured protein fibers more readily than wool. Also, the manufactured fibers decomposed to some extent in the salt solution containing no enzyme, which was used as a control. Both corn and peanut fibers were attacked by the enzyme pepsin. Casein bristles and the peanut fibers were found to be most susceptible to trypsin. Only the peanut fiber was digested to any appreciable extent by the enzyme papain.



## CLOTHING CONSTRUCTION

Laboratory studies are being made comparing different techniques in home and factory sewing as a basis for developing specifications for details of clothing construction. One of the first techniques to be considered was buttonhole construction, including the effect of the number and kind of stitches, the kind and size of thread, the fabric, and the position of the buttonholes upon their abrasion resistance.

Whip buttonholes worked on percale of medium quality were more resistant to abrasion than buttonholes worked on fabric of higher and lower grade. The buttonholes on the best quality percale ranked second in resisting abrasion; those on the poorest quality ranked last.

The so-called purl buttonhole was found to be significantly more resistant to abrasion than the whip buttonhole, when both were made on the same buttonhole machine and when fabric, thread, and number of stitches were the same. Both of these types of buttonhole averaged from two to three and one-half times more resistant to abrasion when worked with 37 stitches per inch than with 17, in tests on percales of four qualities.

Sewing-machine stitching is basic to many garment construction processes, yet little has been published about the influence of various elements upon the breaking strength of such stitching. During the past year the Bureau has studied the effect of two variables on strength of seams: Number of stitches per inch and tension on the thread.

A single thickness of gingham was stitched in the warp, filling, bias, and garment-bias directions. With eight different numbers of stitches, from 7 to 20 per inch, and with eight different tensions, from 50 to 400 grams, on the upper thread, the breaking strength of the stitching ranged from 1.9 to 22.05 pounds. In every case, the average breaking strength of the stitching was less than that of the fabric on which the stitching was made. All stitching on the bias was weak. The breaking strength of the strongest bias stitching was only 4.2 pounds as contrasted with 20.60 pounds for the strongest warp stitching and 22.05 for the strongest filling stitching.

## PUBLISHING RESULTS

Research findings of the Bureau are presented to the public in the form of technical and popular United States Department of Agriculture bulletins and leaflets and articles in professional and popular journals and magazines and in various visual forms, as well as through press releases, the radio, and occasionally motion pictures. The record for the year July 1, 1947, to June 30, 1948, is as follows: 32 publications printed or processed; 25 technical articles printed in professional journals; 86 popular articles and press releases; 10 radio scripts written or broadcast. An additional 11 publications are in press, and 11 technical articles and 7 popular articles have been completed and submitted for printing. Distribution by request for the 129 popular and technical publications currently in circulation totaled about 8 million copies for the past year.

Helping to mark the beginning of a second quarter century of service, the Bureau also issued this year a motion picture in color, showing various aspects of its research program. A limited number of prints are available for loan.

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